Are great earthquakes clustered?

Guillaume Ominetti

The rate of very powerful earthquakes occurring worldwide has significantly increased over the past decade. In fact, the records of these very large seismic events seemingly reveal periods of cluster and quiescence over the whole of the last century.

These observations have fuelled concern that these great quakes may not be independent events and may cluster in time. If this feature turned out to be true, it would have a major impact on how we assess seismic hazard.

A number of academic studies have investigated this question, in particular since 2005 in the wake of the 2004 M_w 9.1 Sumatra-Andaman mega earthquake. Seismologists and geophysicists have tried to infer whether an underlying physical phenomenon could drive such clustering. However, no clear consensus has been reached so far.

In parallel, statisticians have also studied the question. Conclusions have been mixed, with some researchers asserting that there is conclusive evidence of clustering, while others feel that what has been observed so far cannot be distinguished from a standard stochastic process, with no memory and constant risk over time, and consequently no clustering pattern.

We will provide some background on the topic and examine the underlying issue, primarily from a statistical point of view.